

KTY81 series

Silicon temperature sensors

Rev. 05 — 25 April 2008 Product data sheet

1. Product profile

1.1 General description

The temperature sensors in the KTY81 series have a positive temperature coefficient of resistance and are suitable for use in measurement and control systems. The sensors are encapsulated in the SOD70 2 in-line leads plastic package.

Other special selections are available on request.

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

1.2 Features

- High accuracy and reliability
- Positive temperature coefficient; fail-safe behavior
- Long-term stability
- Virtually linear characteristics

1.3 Quick reference data

Table 1. Quick reference data

T_{amb} = 25 °C; in liquid; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R_{25}	sensor resistance	$I_{sen(cont)}$ = 1 mA				
		KTY81/110	990	-	1010	Ω
		KTY81/120	980	-	1020	Ω
		KTY81/121	980	-	1000	Ω
		KTY81/122	1000	-	1020	Ω
		KTY81/150	950	-	1050	Ω
		KTY81/210	1980	-	2020	Ω
		KTY81/220	1960	-	2040	Ω
		KTY81/221	1960	-	2000	Ω
		KTY81/222	2000	-	2040	Ω
		KTY81/250	1900	-	2100	Ω



2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline
1	electrical contact	
2	electrical contact	

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
KTY81/110	-	plastic near cylindrical single-ended package; 2 in-line leads	SOD70
KTY81/120			
KTY81/121			
KTY81/122			
KTY81/150			
KTY81/210			
KTY81/220			
KTY81/221			
KTY81/222			
KTY81/250			

4. Marking

Table 4. Marking codes

Type number	Marking code
KTY81/110	110
KTY81/120	120
KTY81/121	121
KTY81/122	122
KTY81/150	150
KTY81/210	210
KTY81/220	220
KTY81/221	221
KTY81/222	222
KTY81/250	250

5. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$I_{sen(cont)}$	continuous sensor current	in free air; T_{amb} = 25 °C	-	10	mA
		in free air; T_{amb} = 150 °C	-	2	mA
T_{amb}	ambient temperature		–55	+150	°C

6. Characteristics

Table 6. Characteristics

T_{amb} = 25 °C; in liquid; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R_{25}	sensor resistance	$I_{sen(cont)}$ = 1 mA					
		KTY81/110		990	-	1010	Ω
		KTY81/120		980	-	1020	Ω
		KTY81/121		980	-	1000	Ω
		KTY81/122		1000	-	1020	Ω
		KTY81/150		950	-	1050	Ω
		KTY81/210		1980	-	2020	Ω
		KTY81/220		1960	-	2040	Ω
		KTY81/221		1960	-	2000	Ω
		KTY81/222		2000	-	2040	Ω
		KTY81/250		1900	-	2100	Ω
TC	temperature coefficient			-	0.79	-	%/K
R_{100}/R_{25}	resistance ratio	T_{amb} = 100 °C and 25 °C		1.676	1.696	1.716	
R_{-55}/R_{25}	resistance ratio	T_{amb} = –55 °C and 25 °C		0.480	0.490	0.500	
ΔR_{25}	drift of sensor resistance at 25 °C	10000 h continuous operation; T_{amb} = 150 °C					
		KTY81/1 series		-	1.6	-	Ω
		KTY81/2 series		-	3.2	-	Ω
τ_{th}	thermal time constant	in still air	[1]	-	30	-	s
		in still liquid	[1]	-	5	-	s
		in flowing liquid	[1]	-	3	-	s

[1] The thermal time constant is the time taken for the sensor to reach 63.2 % of the total temperature difference. For example, if a sensor with a temperature of 25 °C is moved to an environment with an ambient temperature of 100 °C, the time for the sensor to reach a temperature of 72.4 °C is the thermal time constant.

Table 7. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/110 and KTY81/120

$I_{sen(cont)} = 1$ *mA.*

Ambient temperature		Temperature coefficient (%/K)	KTY81/110				KTY81/120			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)	Resistance (Ω)			Temperature error (K)
			Min	Typ	Max		Min	Typ	Max	
–55	–67	0.99	475	490	505	±3.02	470	490	510	±4.02
–50	–58	0.98	500	515	530	±2.92	495	515	535	±3.94
–40	–40	0.96	552	567	582	±2.74	547	567	588	±3.78
–30	–22	0.93	609	624	638	±2.55	603	624	645	±3.62
–20	–4	0.91	669	684	698	±2.35	662	684	705	±3.45
–10	14	0.88	733	747	761	±2.14	726	747	769	±3.27
0	32	0.85	802	815	828	±1.91	793	815	836	±3.08
10	50	0.83	874	886	898	±1.67	865	886	907	±2.88
20	68	0.80	950	961	972	±1.41	941	961	982	±2.66
25	77	0.79	990	1000	1010	±1.27	980	1000	1020	±2.54
30	86	0.78	1029	1040	1051	±1.39	1018	1040	1061	±2.68
40	104	0.75	1108	1122	1136	±1.64	1097	1122	1147	±2.97
50	122	0.73	1192	1209	1225	±1.91	1180	1209	1237	±3.28
60	140	0.71	1278	1299	1319	±2.19	1265	1299	1332	±3.61
70	158	0.69	1369	1392	1416	±2.49	1355	1392	1430	±3.94
80	176	0.67	1462	1490	1518	±2.8	1447	1490	1532	±4.3
90	194	0.65	1559	1591	1623	±3.12	1543	1591	1639	±4.66
100	212	0.63	1659	1696	1733	±3.46	1642	1696	1750	±5.05
110	230	0.61	1762	1805	1847	±3.83	1744	1805	1865	±5.48
120	248	0.58	1867	1915	1963	±4.33	1848	1915	1982	±6.07
125	257	0.55	1919	1970	2020	±4.66	1899	1970	2040	±6.47
130	266	0.52	1970	2023	2077	±5.07	1950	2023	2097	±6.98
140	284	0.45	2065	2124	2184	±6.28	2043	2124	2205	±8.51
150	302	0.35	2145	2211	2277	±8.55	2123	2211	2299	±11.43

Table 8. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/121 and KTY81/122

$I_{sen(cont)}$ = 1 mA.

Ambient temperature		Temperature coefficient (%/K)	KTY81/121				KTY81/122			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)	Resistance (Ω)			Temperature error (K)
			Min	Typ	Max		Min	Typ	Max	
–55	–67	0.99	471	485	500	±3.02	480	495	510	±3.02
–50	–58	0.98	495	510	524	±2.92	505	520	535	±2.92
–40	–40	0.96	547	562	576	±2.74	558	573	588	±2.74
–30	–22	0.93	603	617	632	±2.55	615	630	645	±2.55
–20	–4	0.91	662	677	691	±2.35	676	690	705	±2.35
–10	14	0.88	726	740	754	±2.14	741	755	769	±2.14
0	32	0.85	794	807	820	±1.91	810	823	836	±1.91
10	50	0.83	865	877	889	±1.67	883	895	907	±1.67
20	68	0.80	941	951	962	±1.41	960	971	982	±1.41
25	77	0.79	980	990	1000	±1.27	1000	1010	1020	±1.27
30	86	0.78	1018	1029	1041	±1.39	1039	1050	1062	±1.39
40	104	0.75	1097	1111	1125	±1.64	1120	1134	1148	±1.64
50	122	0.73	1180	1196	1213	±1.91	1204	1221	1238	±1.91
60	140	0.71	1266	1286	1305	±2.19	1291	1312	1332	±2.19
70	158	0.69	1355	1378	1402	±2.49	1382	1406	1430	±2.49
80	176	0.67	1447	1475	1502	±2.8	1477	1505	1533	±2.8
90	194	0.65	1543	1575	1607	±3.12	1574	1607	1639	±3.12
100	212	0.63	1642	1679	1716	±3.46	1676	1713	1750	±3.46
110	230	0.61	1745	1786	1828	±3.83	1780	1823	1865	±3.83
120	248	0.58	1849	1896	1943	±4.33	1886	1934	1982	±4.33
125	257	0.55	1900	1950	2000	±4.66	1938	1989	2041	±4.66
130	266	0.52	1950	2003	2056	±5.07	1989	2044	2098	±5.07
140	284	0.45	2044	2103	2162	±6.28	2085	2146	2206	±6.28
150	302	0.35	2124	2189	2254	±8.55	2167	2233	2299	±8.55

Table 9. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/150

$I_{sen(cont)}$ = 1 mA.

Ambient temperature		Temperature coefficient (%/K)	KTY81/150			
			Resistance (Ω)			Temperature error (K)
(°C)	(°F)		Min	Typ	Max	
–55	–67	0.99	456	490	524	±7.04
–50	–58	0.98	479	515	550	±6.99
–40	–40	0.96	530	567	605	±6.91
–30	–22	0.93	584	624	663	±6.84
–20	–4	0.91	642	684	725	±6.77
–10	14	0.88	703	747	791	±6.69
0	32	0.85	769	815	861	±6.61
10	50	0.83	838	886	934	±6.51
20	68	0.80	912	961	1010	±6.41
25	77	0.79	950	1000	1050	±6.35
30	86	0.78	987	1040	1093	±6.55
40	104	0.75	1064	1122	1181	±6.97
50	122	0.73	1143	1209	1274	±7.4
60	140	0.71	1226	1299	1371	±7.85
70	158	0.69	1313	1392	1472	±8.31
80	176	0.67	1402	1490	1577	±8.79
90	194	0.65	1495	1591	1687	±9.29
100	212	0.63	1591	1696	1801	±9.81
110	230	0.61	1690	1805	1919	±10.4
120	248	0.58	1791	1915	2039	±11.28
125	257	0.55	1840	1970	2099	±11.91
130	266	0.52	1889	2023	2158	±12.72
140	284	0.45	1980	2124	2269	±15.21
150	302	0.35	2057	2211	2365	±20.09

Table 10. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/210 and KTY81/220

$I_{sen(cont)}$ = 1 mA.

Ambient temperature		Temperature coefficient (%/K)	KTY81/210				KTY81/220			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)	Resistance (Ω)			Temperature error (K)
			Min	Typ	Max		Min	Typ	Max	
–55	–67	0.99	951	980	1009	±3.02	941	980	1019	±4.02
–50	–58	0.98	1000	1030	1059	±2.92	990	1030	1070	±3.94
–40	–40	0.96	1105	1135	1165	±2.74	1094	1135	1176	±3.78
–30	–22	0.93	1218	1247	1277	±2.55	1205	1247	1289	±3.62
–20	–4	0.91	1338	1367	1396	±2.35	1325	1367	1410	±3.45
–10	14	0.88	1467	1495	1523	±2.14	1452	1495	1538	±3.27
0	32	0.85	1603	1630	1656	±1.91	1587	1630	1673	±3.08
10	50	0.83	1748	1772	1797	±1.67	1730	1772	1814	±2.88
20	68	0.80	1901	1922	1944	±1.41	1881	1922	1963	±2.66
25	77	0.79	1980	2000	2020	±1.27	1960	2000	2040	±2.54
30	86	0.78	2057	2080	2102	±1.39	2036	2080	2123	±2.68
40	104	0.75	2217	2245	2272	±1.64	2194	2245	2295	±2.97
50	122	0.73	2383	2417	2451	±1.91	2359	2417	2475	±3.28
60	140	0.71	2557	2597	2637	±2.19	2531	2597	2663	±3.61
70	158	0.69	2737	2785	2832	±2.49	2709	2785	2860	±3.94
80	176	0.67	2924	2980	3035	±2.8	2894	2980	3065	±4.3
90	194	0.65	3118	3182	3246	±3.12	3086	3182	3278	±4.66
100	212	0.63	3318	3392	3466	±3.46	3284	3392	3500	±5.05
110	230	0.59	3523	3607	3691	±3.93	3487	3607	3728	±5.61
120	248	0.53	3722	3817	3912	±4.7	3683	3817	3950	±6.59
125	257	0.49	3815	3915	4016	±5.26	3775	3915	4055	±7.31
130	266	0.44	3901	4008	4114	±6	3861	4008	4154	±8.27
140	284	0.33	4049	4166	4283	±8.45	4008	4166	4325	±11.46
150	302	0.20	4153	4280	4407	±14.63	4110	4280	4450	±19.56

Table 11. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/221 and KTY81/222

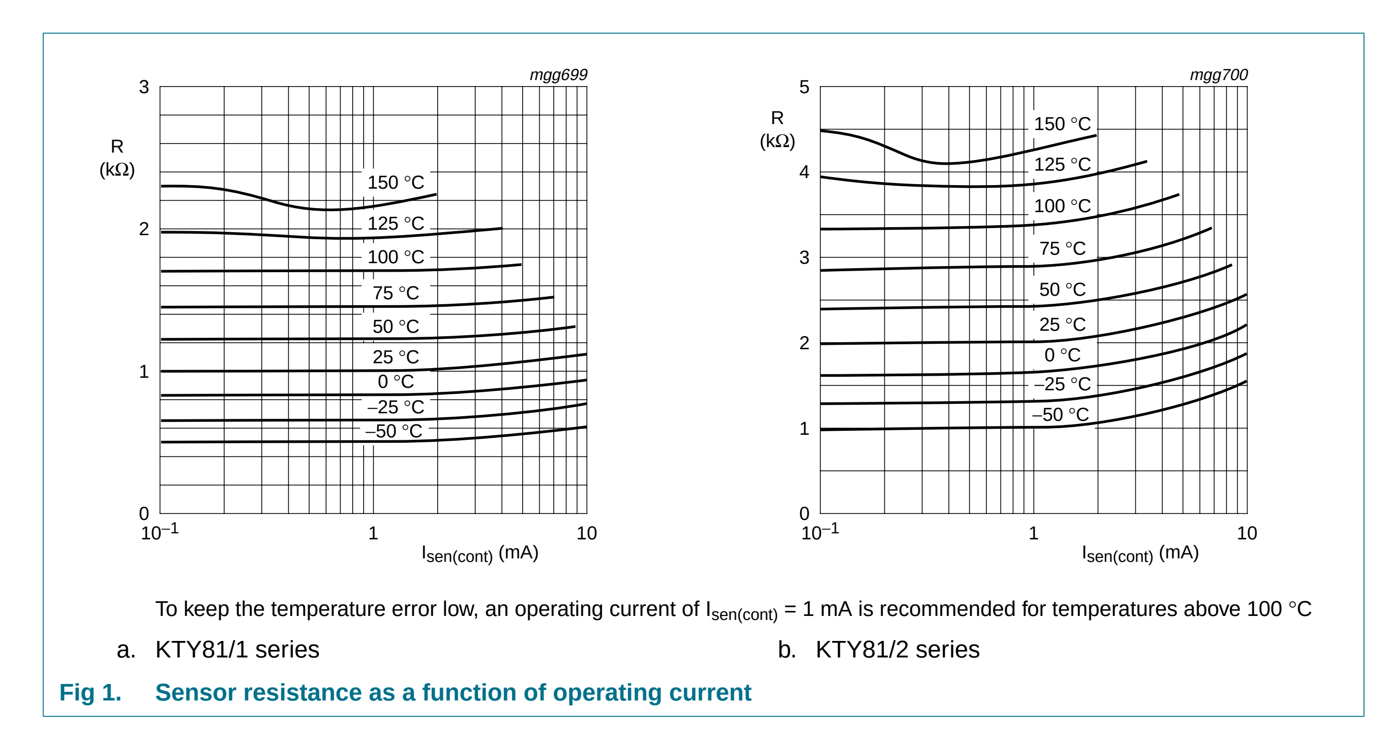
$I_{sen(cont)}$ = 1 mA.

Ambient temperature		Temperature coefficient (%/K)	KTY81/221				KTY81/222			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)	Resistance (Ω)			Temperature error (K)
			Min	Typ	Max		Min	Typ	Max	
–55	–67	0.99	941	970	999	±3.02	960	990	1020	±3.02
–50	–58	0.98	990	1019	1049	±2.92	1010	1040	1070	±2.92
–40	–40	0.96	1094	1123	1153	±2.74	1116	1146	1176	±2.74
–30	–22	0.93	1205	1235	1264	±2.55	1230	1260	1290	±2.55
–20	–4	0.91	1325	1354	1382	±2.35	1352	1381	1410	±2.35
–10	14	0.88	1452	1480	1508	±2.14	1481	1510	1538	±2.14
0	32	0.85	1587	1613	1640	±1.91	1619	1646	1673	±1.91
10	50	0.83	1730	1754	1779	±1.67	1765	1790	1815	±1.67
20	68	0.80	1882	1903	1924	±1.41	1920	1941	1963	±1.41
25	77	0.79	1960	1980	2000	±1.27	2000	2020	2040	±1.27
30	86	0.78	2037	2059	2081	±1.39	2078	2100	2123	±1.39
40	104	0.75	2195	2222	2250	±1.64	2239	2267	2295	±1.64
50	122	0.73	2360	2393	2426	±1.91	2407	2441	2475	±1.91
60	140	0.71	2531	2571	2611	±2.19	2582	2623	2664	±2.19
70	158	0.69	2710	2757	2804	±2.49	2764	2812	2860	±2.49
80	176	0.67	2895	2950	3005	±2.8	2953	3009	3065	±2.8
90	194	0.65	3086	3150	3214	±3.12	3149	3214	3279	±3.12
100	212	0.63	3285	3358	3431	±3.46	3351	3426	3501	±3.46
110	230	0.59	3488	3571	3655	±3.93	3558	3643	3728	±3.93
120	248	0.53	3684	3779	3873	±4.7	3759	3855	3951	±4.7
125	257	0.49	3776	3876	3976	±5.26	3853	3955	4056	±5.26
130	266	0.44	3862	3967	4073	±6	3940	4048	4155	±6
140	284	0.33	4009	4125	4241	±8.45	4090	4208	4326	±8.45
150	302	0.20	4112	4237	4363	±14.63	4195	4323	4451	±14.63

Table 12. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81/250

$I_{sen(cont)}$ = 1 mA.

Ambient temperature		Temperature coefficient (%/K)	KTY81/250			
(°C)	(°F)		Resistance (Ω)			Temperature error (K)
			Min	Typ	Max	
–55	–67	0.99	911	980	1049	±7.04
–50	–58	0.98	959	1030	1101	±6.99
–40	–40	0.96	1060	1135	1210	±6.91
–30	–22	0.93	1168	1247	1327	±6.84
–20	–4	0.91	1283	1367	1451	±6.77
–10	14	0.88	1407	1495	1583	±6.69
0	32	0.85	1538	1630	1721	±6.61
10	50	0.83	1677	1772	1867	±6.51
20	68	0.80	1824	1922	2021	±6.41
25	77	0.79	1900	2000	2100	±6.35
30	86	0.78	1974	2080	2185	±6.55
40	104	0.75	2127	2245	2362	±6.97
50	122	0.73	2287	2417	2547	±7.4
60	140	0.71	2453	2597	2741	±7.85
70	158	0.69	2626	2785	2943	±8.31
80	176	0.67	2805	2980	3154	±8.79
90	194	0.65	2990	3182	3374	±9.29
100	212	0.63	3182	3392	3602	±9.81
110	230	0.59	3379	3607	3836	±10.65
120	248	0.53	3569	3817	4065	±12.25
125	257	0.49	3658	3915	4173	±13.45
130	266	0.44	3741	4008	4274	±15.06
140	284	0.33	3883	4166	4450	±20.49
150	302	0.20	3982	4280	4578	±34.35

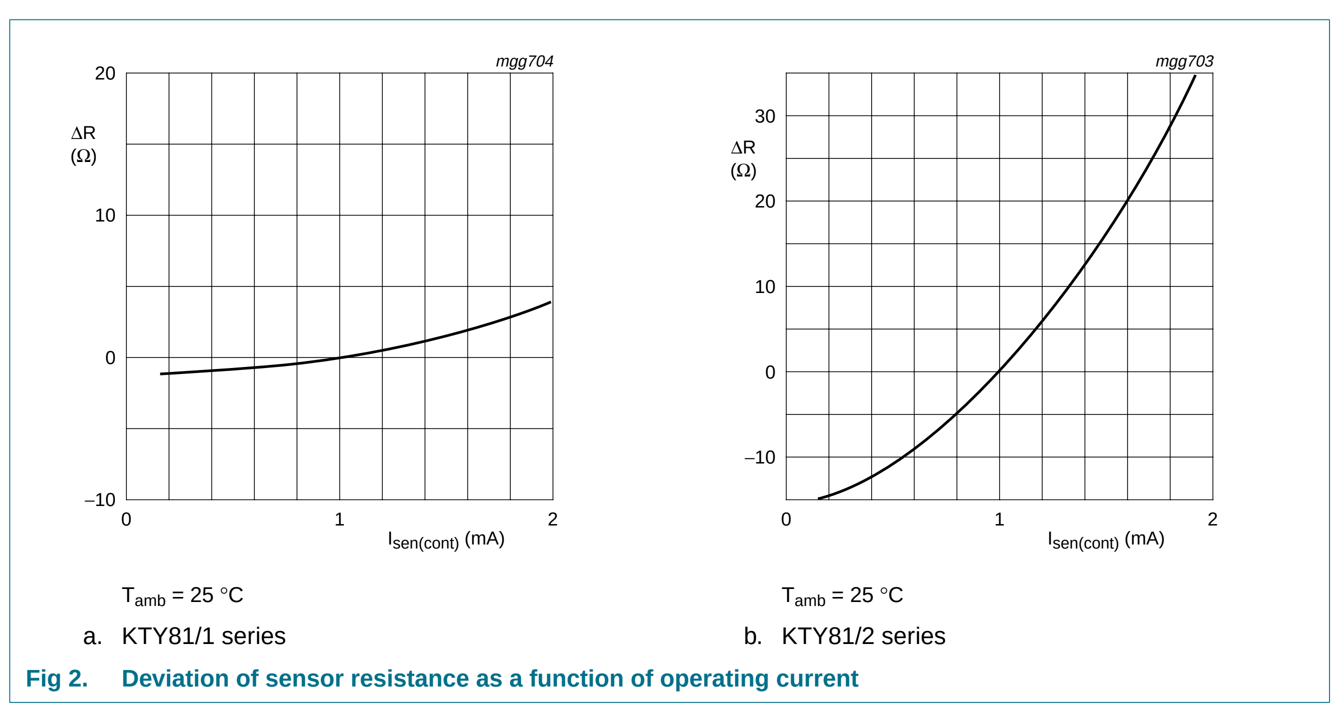


To keep the temperature error low, an operating current of $I_{sen(cont)}$ = 1 mA is recommended for temperatures above 100 °C

a. KTY81/1 series

b. KTY81/2 series

Fig 1. Sensor resistance as a function of operating current



T_{amb} = 25 °C

a. KTY81/1 series

T_{amb} = 25 °C

b. KTY81/2 series

Fig 2. Deviation of sensor resistance as a function of operating current

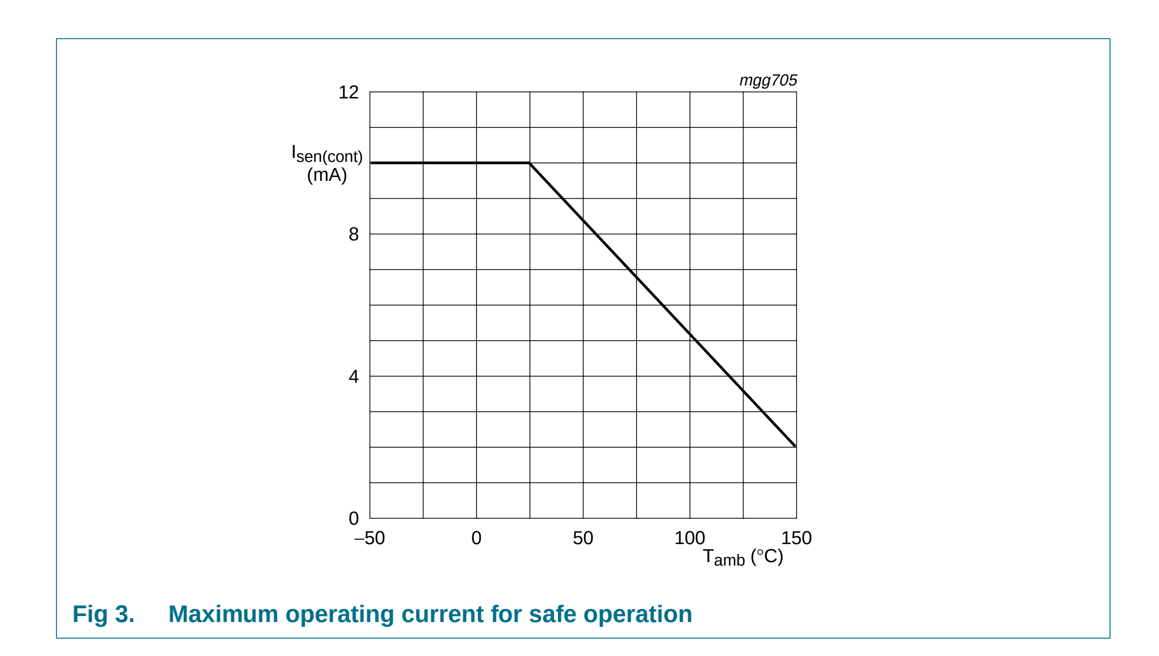


Fig 3. Maximum operating current for safe operation

7. Package outline

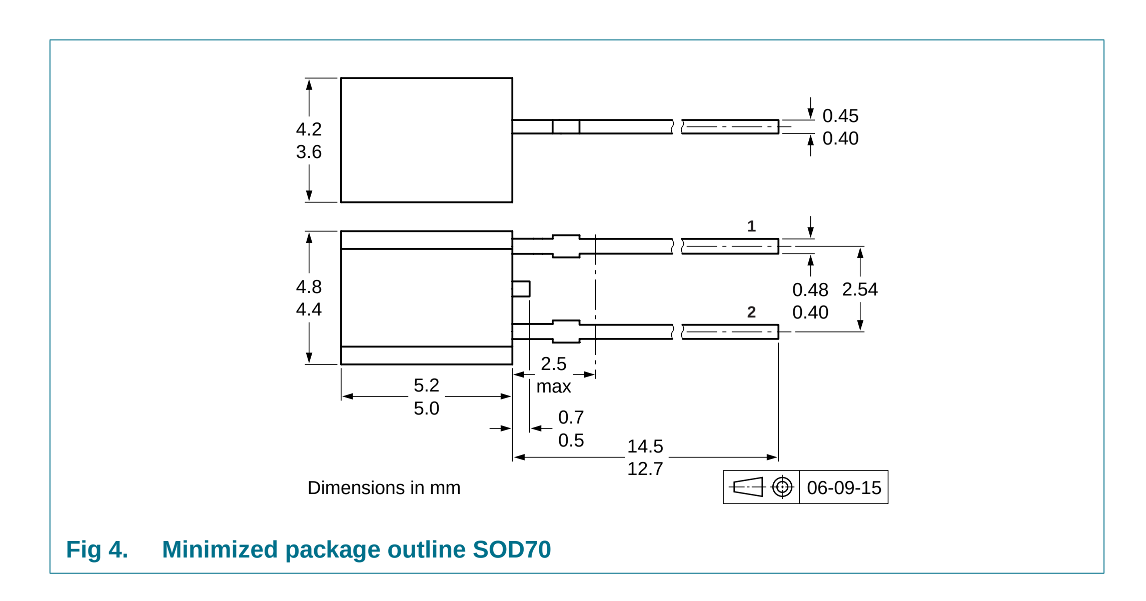


Fig 4. Minimized package outline SOD70

8. Packing information

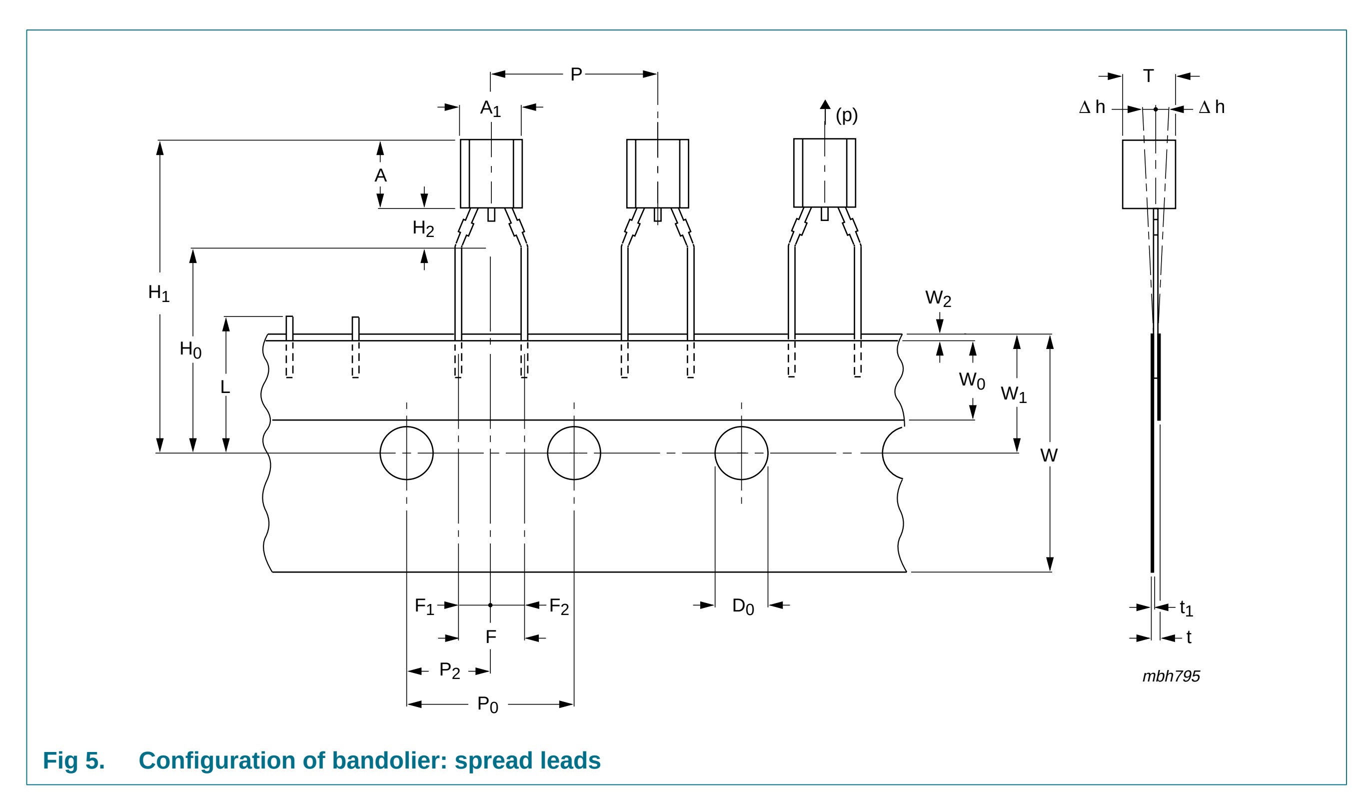


Fig 5. Configuration of bandolier: spread leads

Note: Types in bulk packaging have a lead-to-lead distance of 2.54 mm (see Figure 4). The lead-to-lead distance of types packaged on reel have a lead-to-lead distance of 5.08 mm, spread leads (see Figure 5).

Table 13. Tape specification

Symbol	Dimension	Specifications					Remarks
		Min	Typ	Max	Tolerance	Unit	
A_1	body width	4.4	-	4.8	-	mm	
A	body height	5	-	5.2	-	mm	
T	body thickness	3.6	-	4.2	-	mm	
P	pitch of component	-	12.7	-	±1	mm	
P_0	feed hole pitch	-	12.7	-	±0.3	mm	
	cumulative pitch error	–1	-	+1	-	mm	measured over 20 devices
P_2	feed hole center to component center	-	6.35	-	±0.4	mm	to be measured at bottom of clinch
F	lead-to-lead distance	-	5.08	-	+0.6/–0.2	mm	spread leads
Δh	component alignment	-	0	1	-	mm	at top of body
W	tape width	-	18	-	±0.5	mm	
W_0	hold-down tape width	-	6	-	±0.2	mm	
W_1	hole position	-	9	-	+0.7/–0.5	mm	
W_2	hold-down tape position	-	0.5	-	±0.2	mm	
H_0	lead wire clinch height	-	16.5	-	±0.5	mm	
H_1	component height	-	-	23.25	-	mm	
L	length of snipped leads	-	-	11	-	mm	
D_0	feed hole diameter	-	4	-	±0.2	mm	
t	total tape thickness	-	-	1.2	-	mm	t_1 = 0.3 mm to 0.6 mm
F_1, F_2	lead to snipped lead distance	-	2.54	-	+0.4/–0.2	mm	spread leads
H_2	clinch height	-	2.5	-	+0.5/0	mm	
(p)	pull-out force	6	-	-	-	N	

9. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
KTY81_SER_5	20080425	Product data sheet	-	KTY81-2SERIES_4 KTY81-1SERIES_3
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate.			
KTY81-2SERIES_4	20000825	Product specification	-	-
KTY81-1SERIES_3	20000825	Product specification	-	-

10. Legal information

10.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term ‘short data sheet’ is explained in section “Definitions”.

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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12. Contents



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